WHAT IS CLAIMED IS:

1. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of an alloy containing at least two kinds of metals among iron (Fe), cobalt (Co) and nickel (Ni) as matrix elements thereof, and in case of a binary alloy, said alloy containing each of said two kinds of matrix elements by not less than 25 atomic % respectively, and in case of a ternary alloy, said alloy containing each of said three kinds of matrix elements by not less than 5 atomic % respectively.

2. The magnetoresistance effect element according to claim 1, wherein said thin-film insertion layer has a thickness not thinner than a single-atomic layer and not thicker than 3 nm.

3. The magnetoresistance effect element according to claim 1, wherein said thin-film insertion layer is placed at a distance of 0 to 2 nm from an interface in contact with said nonmagnetic intermediate layer.

4. The magnetoresistance effect element according to claim 1, wherein said thin-film insertion layer is placed in said pinned layer or said free layer to lie at a distance of 0 to 2 nm from an interface of said pinned layer not in contact with said nonmagnetic intermediate layer or from an interface of said free layer not in contact with said nonmagnetic intermediate layer.

5. The magnetoresistance effect element according to claim 1, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

6. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned

layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of a binary alloy or a ternary alloy containing at least two kinds of metals among iron (Fe), cobalt (Co) and nickel (Ni) as matrix elements thereof, and additionally containing a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum (Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) not less than 0.1 atomic % and not exceeding 30 atomic %.

7. The magnetoresistance effect element according to claim 6, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

8. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being a binary alloy containing a quantity of iron (Fe) not less than 50 atomic % as the major component thereof, or a ternary alloy containing a quantity of iron (Fe) not less than 25 atomic % as the major component thereof, and said alloy having a body-centered cubic crystal structure.

9. The magnetoresistance effect element according to claim 8, wherein said alloy additionally contains at least one kind of element selected from the group consisting of cobalt (Co), nickel (Ni), chromium (Cr), vanadium (V), manganese (Mn), rhodium (Rh), titanium (Ti), molybdenum (Mo), tungsten (W), niobium (Nb), tantalum (Ta), palladium (Pd), platinum (Pt), zirconium (Zr) and hafnium (Hf).

10. The magnetoresistance effect element according to claim 8, wherein said alloy additionally contains a quantity of at least one kind of element selected from the group consisting of manganese (Mn), copper (Cu), rhenium (Re), ruthenium (Ru), palladium (Pd), platinum (Pt), silver (Ag), gold (Au) and aluminum (Al) not less than 0.1 atomic % and not exceeding 20 atomic %, or contains a quantity of at least one kind of element selected from the group consisting of scandium (Sc), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), boron (B), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (0), fluorine (F) and nitrogen (N) not less than 0.1 atomic % and not exceeding 10 atomic %.

11. The magnetoresistance effect element according to claim 8, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

12. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and

a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of iron (Fe) having a body-centered cubic crystal structure.

13. The magnetoresistance effect element according to claim 12, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

14. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current

perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of an alloy containing iron (Fe) and chromium (Cr) as major components thereof and adjusted in quantity of chromium (Cr) in the range from 0 atomic % to 80 atomic %, said alloy having a body-centered cubic crystal structure.

15. The magnetoresistance effect element according to claim 14, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

16. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of an alloy containing iron (Fe) and vanadium (V) as major components thereof and adjusted in quantity of vanadium (V) in the range from 0 atomic % to 70 atomic %, said alloy having a body-centered cubic crystal structure.

17. The magnetoresistance effect element according to claim 16, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

18. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer

including a thin-film insertion layer, and

said thin-film insertion layer being made of iron (Fe), or a binary or ternary alloy of iron (Fe), cobalt (Co) and nickel (Ni) containing a quantity of iron (Fe) not less than 50 atomic % in case of said binary alloy or 25% atomic % in case of said ternary alloy, and additionally containing a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum (Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) not less than 0.1 atomic % and not exceeding 30 atomic %.

19. The magnetoresistance effect element according to claim 18, wherein said alloy additionally contains a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), copper (Cu), zinc (Zn) and gallium (Ga) not less than 0.1 atomic % and not exceeding 30 atomic %.

20. The magnetoresistance effect element according to claim 18, wherein said thin-film insertion layer is a binary alloy of iron (Fe) and nickel (Ni) containing nickel (Ni) by a quantity not less

than 0.1 atomic % and not exceeding 5 atomic %.

21. The magnetoresistance effect element according to claim 18, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

22. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of cobalt (Co), or a binary or ternary alloy of iron (Fe), cobalt (Co) and nickel (Ni) containing a quantity of cobalt (Co) not less than 50 atomic % in case of said binary alloy or 25% atomic % in case of said ternary alloy, and additionally containing a quantity of at least one kind of element

selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum (Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) not less than 0.1 atomic % and not exceeding 30 atomic %.

23. The magnetoresistance effect element according to claim 22, wherein said alloy additionally contains a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu) and hafnium (Hf) not less than 0.1 atomic % and not exceeding 30 atomic %.

24. The magnetoresistance effect element according to claim 22, wherein said thin-film insertion layer is a alloy of cobalt (Co) and at least one element selected from the group consisting of iron (Fe) and nickel (Ni) containing iron (Fe) or nickel (Ni) by a quantity not less than 0.1 atomic % and not exceeding 5 atomic %.

25. The magnetoresistance effect element according to claim 22, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these

metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

26. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of nickel (Ni), or a binary or ternary alloy of iron (Fe), cobalt (Co) and nickel (Ni) containing a quantity of nickel (Ni) not less than 50 atomic % in case of said binary alloy or 25% atomic % in case of said ternary alloy, and additionally containing a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum

(Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) not less than 0.1 atomic % and not exceeding 30 atomic %.

27. The magnetoresistance effect element according to claim 26, wherein said alloy additionally contains a quantity of at least one kind of element selected from the group consisting of titanium (Ti), manganese (Mn), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr) and hafnium (Hf) not less than 0.1 atomic % and not exceeding 30 atomic %.

28. The magnetoresistance effect element according to claim 26, wherein said thin-film insertion layer is a alloy of nickel (Ni) and at least one element selected from the group consisting of iron (Fe) and cobalt (Co) containing iron (Fe) or cobalt (Co) by a quantity not less than 0.1 atomic % and not exceeding 5 atomic %.

29. The magnetoresistance effect element according to claim 26, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

30. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically

pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of a iron (Fe)-cobalt (Co)-system alloy having a body-centered cubic crystal structure, and additionally containing a quantity of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum (Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum (Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) not less than 0.1 atomic % and not exceeding 10 atomic %.

31. The magnetoresistance effect element according to claim 30, wherein said thin-film insertion layer contains copper (Cu)

not less than 0.1 atomic % and not exceeding 10 atomic %.

32. The magnetoresistance effect element according to claim 30, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

33. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of a iron (Fe)-cobalt (Co)-system alloy having a body-centered cubic crystal structure, and layers made of at least one kind of element selected from the group consisting of chromium (Cr), vanadium (V), tantalum

(Ta), niobium (Nb), scandium (Sc), titanium (Ti), manganese (Mn), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), zirconium (Zr), hafnium (Hf), yttrium (Y), technetium (Tc), rhenium (Re), ruthenium (Ru), rhodium (Rh), iridium (Ir), palladium (Pd), platinum (Pt), silver (Ag), gold (Au), boron (B), aluminum (Al), indium (In), carbon (C), silicon (Si), tin (Sn), calcium (Ca), strontium (Sr), barium (Ba), oxygen (O), nitrogen (N) and fluorine (F) having a thickness not thinner than 0.03 nm and not exceeding 1 nm which permits said layers to exist as a body-centered cubic structure being periodically inserted in said alloy.

34. The magnetoresistance effect element according to claim 33, wherein said layers are made copper (Cu.

35. The magnetoresistance effect element according to claim 33, wherein a back insertion layer made of copper (Cu), gold (Au), silver (Ag) or an alloy combining at least two kinds of these metals is provided adjacent to an interface of said free layer not in contact with said nonmagnetic intermediate layer.

36. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and

a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer,

said nonmagnetic metal intermediate layer having a resistance adjusting layer including at least one of oxides, nitrides and fluorides, and

said thin-film insertion layer including at least one element selected from the group consisting of iron (Fe), cobalt (Co) and nickel (Ni).

37. The magnetoresistance effect element according to claim 36, wherein said resistance adjusting layer has a thickness not thinner than 0.2 nm and not exceeding 3 nm.

38. The magnetoresistance effect element according to claim 36, wherein said resistance adjusting layer is placed at a distance of 0 to 1 nm from an interface in contact with said free layer.

39. The magnetoresistance effect element according to claim 36, wherein said resistance adjusting layer is placed at a distance of 0 to 1 nm from an interface in contact with said pinned

layer.

40. The magnetoresistance effect element according to claim 36, wherein said resistance adjusting layer includes an oxide of at least one kind of element selected from the group consisting of boron (B), silicon (Si), germanium (Ge), tantalum (Ta), tungsten (W), niobium (Nb), aluminum (Al), molybdenum (Mo), phosphorus (P), vanadium (V), arsenic (As), antimony (Sb), zirconium (Zr), titanium (Ti), zinc (Zn), lead (Pb), thorium (Th), beryllium (Be), cadmium (Cd), scandium (Sc), lanthanum (La), yttrium (Y), praseodymium (Pr), chromium (Cr), tin (Sn), gallium (Ga), indium (In), rhodium (Rh), magnesium (Mg), lithium (Li), barium (Ba), calcium (Ca), strontium (Sr), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), rubidium (Rb) and rare earth metals, as major component thereof,

said oxide including an element selected from the group consisting of copper (Cu), gold (Au), silver (Ag), platinum (Pt), palladium (Pd), iridium (Ir) and osmium (Os) not less than 1 atomic % and not exceeding 50 atomic %.

41. A magnetoresistance effect element comprising:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned

layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer,

at least one of said pinned layer and said free layer having a resistance adjusting layer including at least one of oxides, nitrides and fluorides, and

said thin-film insertion layer including at least one element selected from the group consisting of iron (Fe), cobalt (Co) and nickel (Ni).

42. The magnetoresistance effect element according to claim 41, wherein said resistance adjusting layer is placed at a distance of 0 to 1 nm from an interface in contact with said nonmagnetic metal intermediate layer.

43. The magnetoresistance effect element according to claim 41, wherein said resistance adjusting layer includes an oxide of at least one kind of element selected from the group consisting of boron (B), silicon (Si), germanium (Ge), tantalum (Ta), tungsten (W), niobium (Nb), aluminum (Al), molybdenum (Mo), phosphorus (P), vanadium (V), arsenic (As), antimony (Sb), zirconium (Zr), titanium (Ti), zinc (Zn), lead (Pb), thorium (Th), beryllium (Be), cadmium (Cd), scandium (Sc), lanthanum (La), yttrium (Y), praseodymium (Pr),

chromium (Cr), tin (Sn), gallium (Ga), indium (In), rhodium (Rh), magnesium (Mg), lithium (Li), barium (Ba), calcium (Ca), strontium (Sr), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), rubidium (Rb) and rare earth metals, as major component thereof,

said oxide including an element selected from the group consisting of copper (Cu), gold (Au), silver (Ag), platinum (Pt), palladium (Pd), iridium (Ir) and osmium (Os) not less than 1 atomic % and not exceeding 50 atomic %.

44. A magnetic head comprising a magnetoresistance effect element having :

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of an alloy containing at least two kinds of metals among iron (Fe), cobalt (Co) and nickel (Ni) as matrix elements thereof, and in case of a binary

alloy, said alloy containing each of said two kinds of matrix elements by not less than 25 atomic % respectively, and in case of a ternary alloy, said alloy containing each of said three kinds of matrix elements by not less than 5 atomic % respectively.

45. A magnetic reproducing apparatus which reads information magnetically recorded in a magnetic recording medium,

said magnetic reproducing apparatus comprising a magnetic head having a magnetoresistance effect element including:

a magnetoresistance effect film including a magnetically pinned layer having a magnetic material film whose direction of magnetization is pinned substantially in one direction, a magnetically free layer having a magnetic material film whose direction of magnetization changes in response to an external magnetic field, and a nonmagnetic metal intermediate layer located between said pinned layer and said free layer; and

a pair of electrodes electrically connected to said magnetoresistance effect film to supply a sense current perpendicularly to a film plane of said magnetoresistance effect film,

at least one of said pinned layer and said free layer including a thin-film insertion layer, and

said thin-film insertion layer being made of an alloy containing at least two kinds of metals among iron (Fe), cobalt (Co) and nickel (Ni) as matrix elements thereof, and in case of a binary alloy, said alloy containing each of said two kinds of matrix elements by not less than 25 atomic % respectively, and in case of a ternary

alloy, said alloy containing each of said three kinds of matrix elements by not less than 5 atomic % respectively.

ABSTRACT OF THE DISCLOSURE

In a spin valve type element, an interface insertion layer (32, 34) of a material exhibiting large spin-dependent interface scattering is inserted in a location of a magnetically pinned layer (16) or a magnetically free layer (20) closer to a nonmagnetic intermediate layer (18). A nonmagnetic back layer (36) may be additionally inserted as an interface not in contact with the nonmagnetic intermediate layer to increase the output by making use of spin-dependent interface scattering along the interface between the pinned layer and the nonmagnetic back layer or between the free layer and the nonmagnetic back layer.

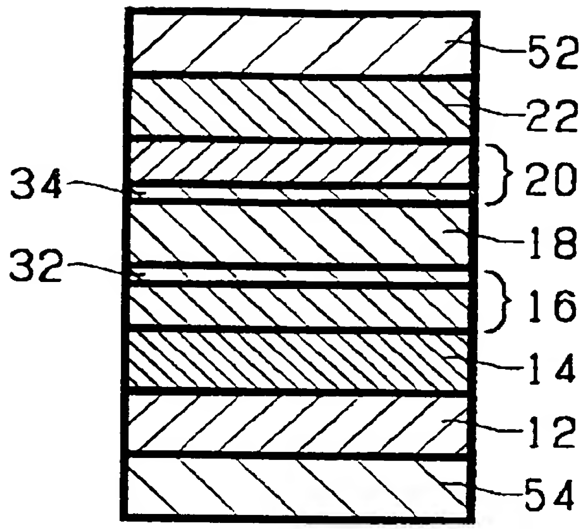

FIG.1

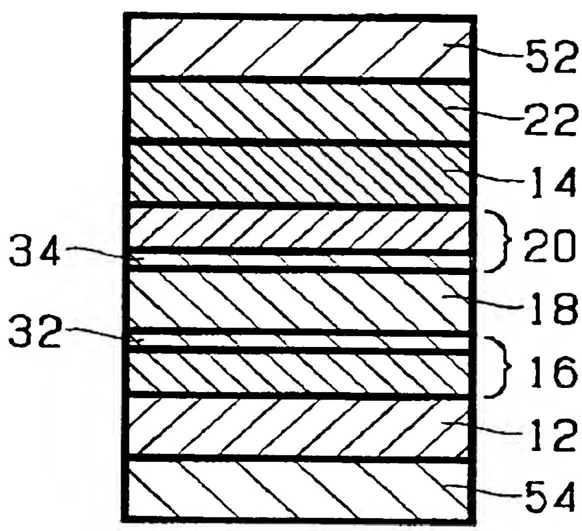

FIG.2

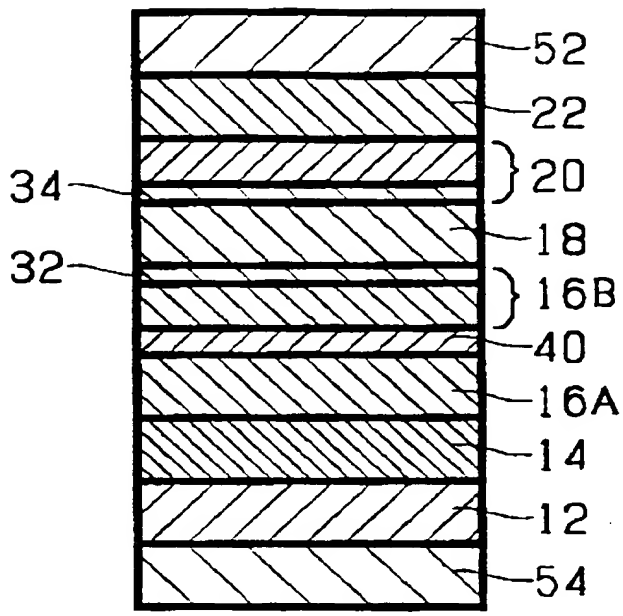
52
22
20
34
18
32
16B
40
16A
14
12
54

FIG.3

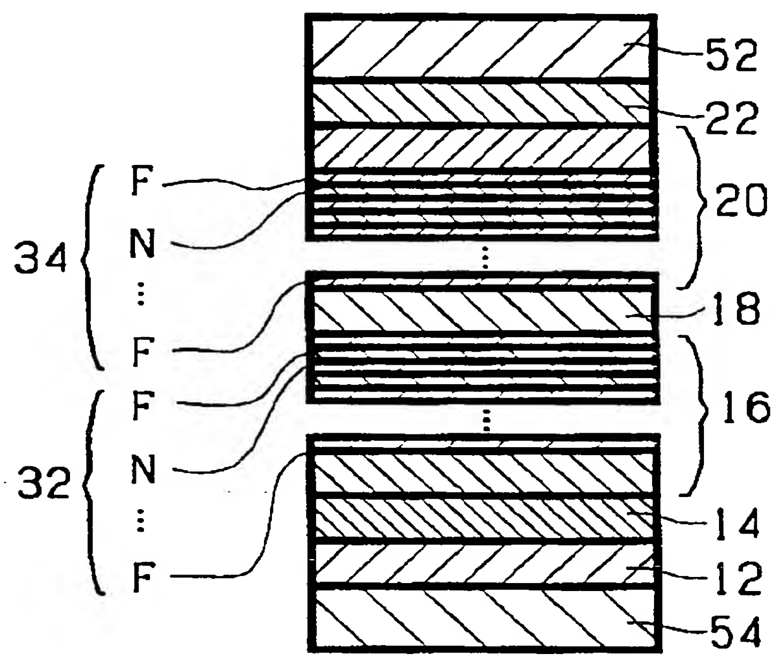
52
22
20
F
N
34
F
18
F
16
N
32
14
F
12
54

FIG.4

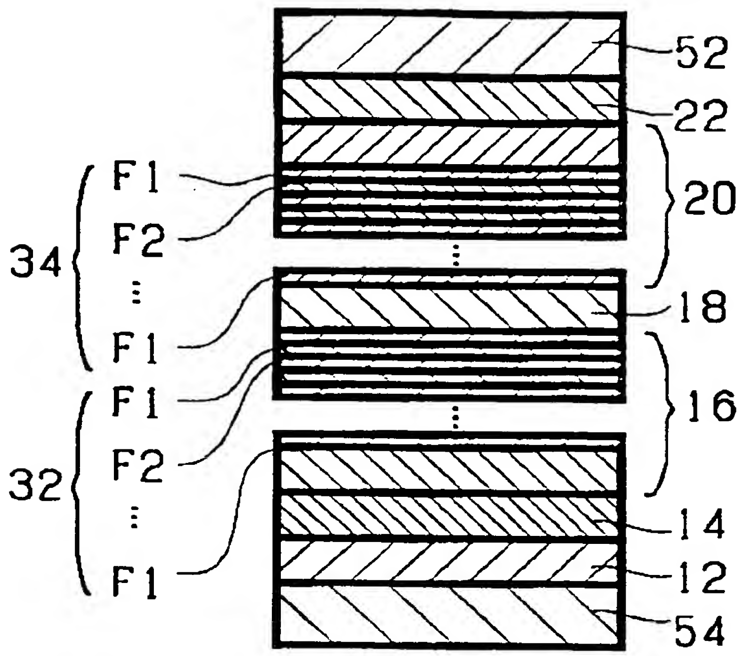

FIG.5

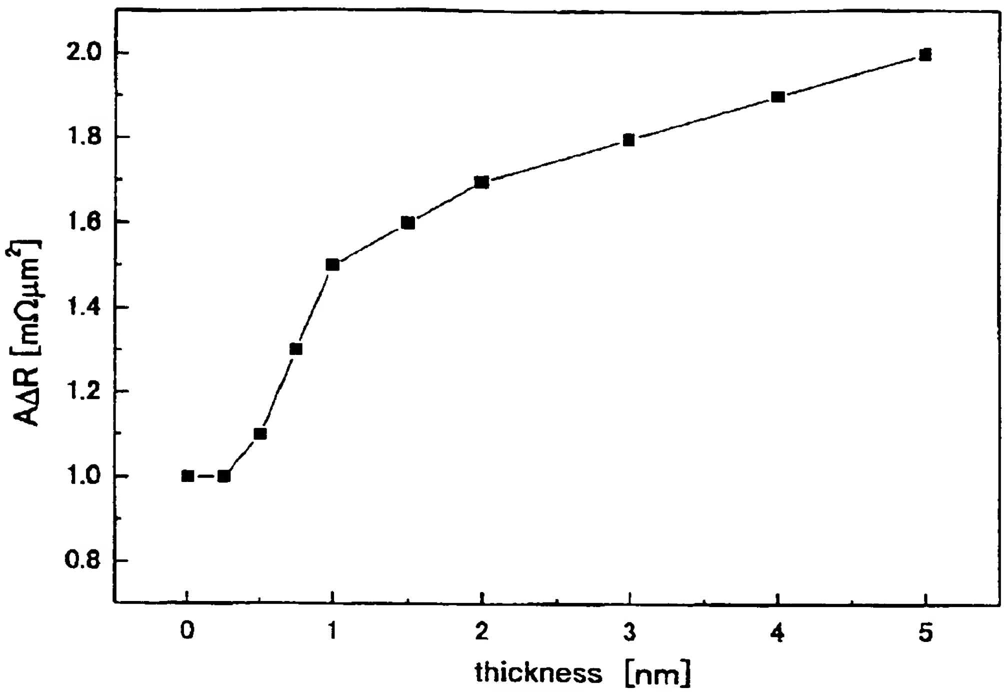
AΔR [mΩμm^2]
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0
1
2
3
4
5
thickness [nm]

FIG.6

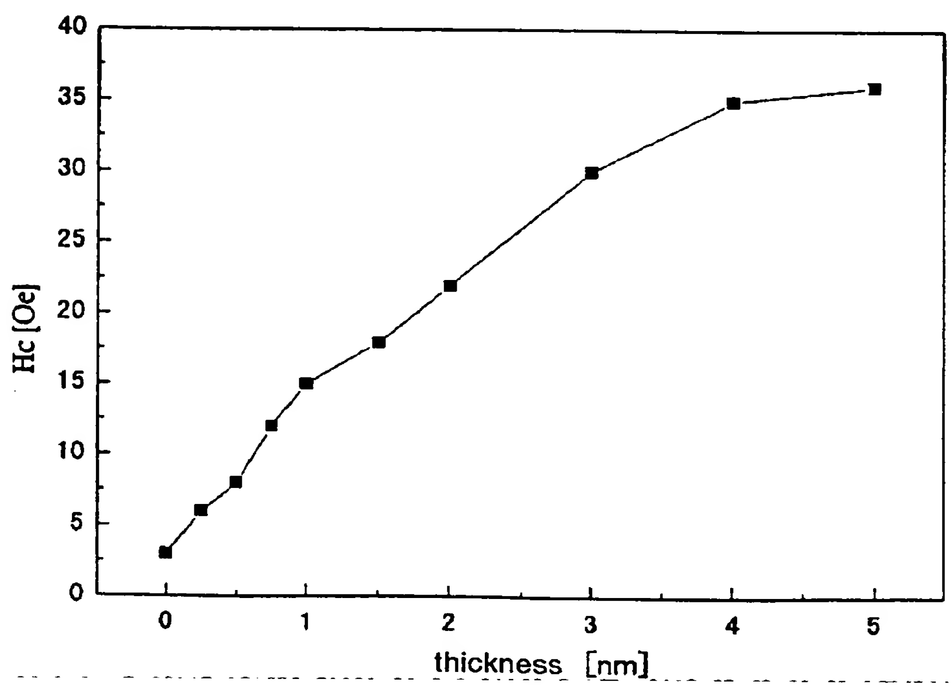
Hc [Oe]
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
thickness [nm]

FIG.7

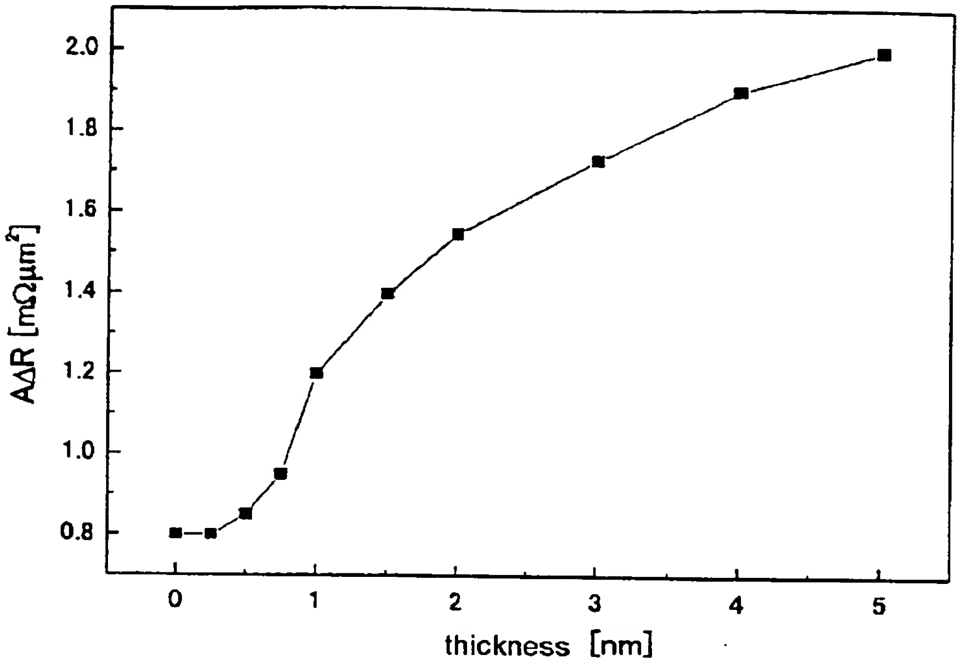
AΔR [mΩμm²]
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0
1
2
3
4
5
thickness [nm]

FIG.8

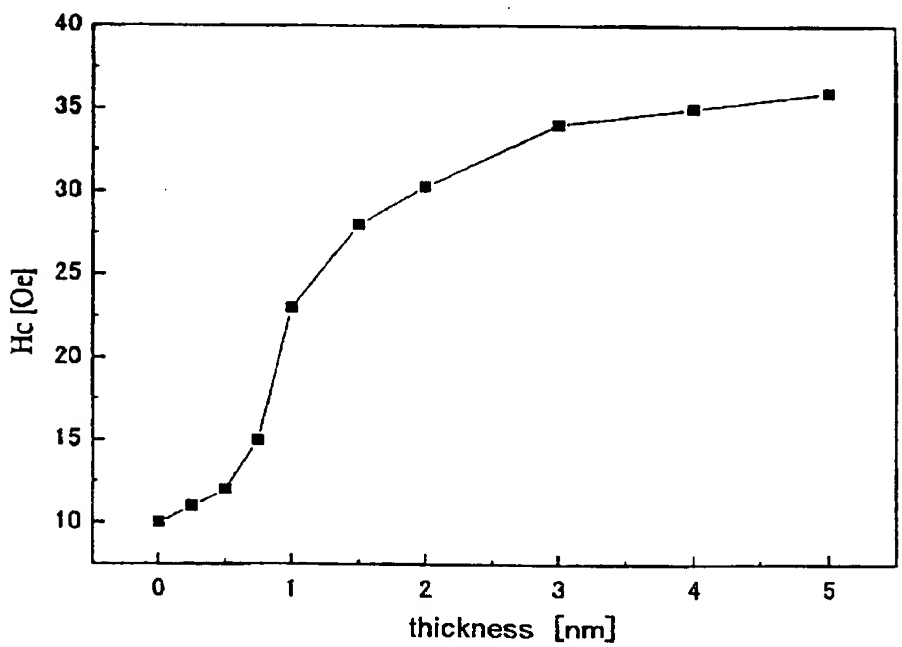
Hc [Oe]
40
35
30
25
20
15
10
0
1
2
3
4
5
thickness [nm]

FIG.9

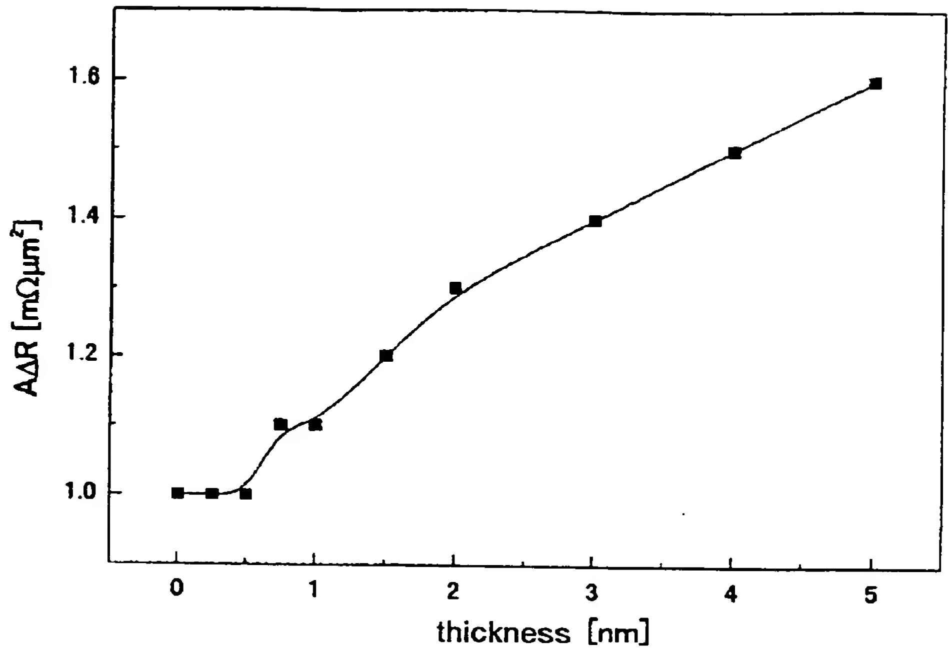
1.6
1.4
1.2
1.0
AΔR [mΩμm²]
0
1
2
3
4
5
thickness [nm]

FIG.10

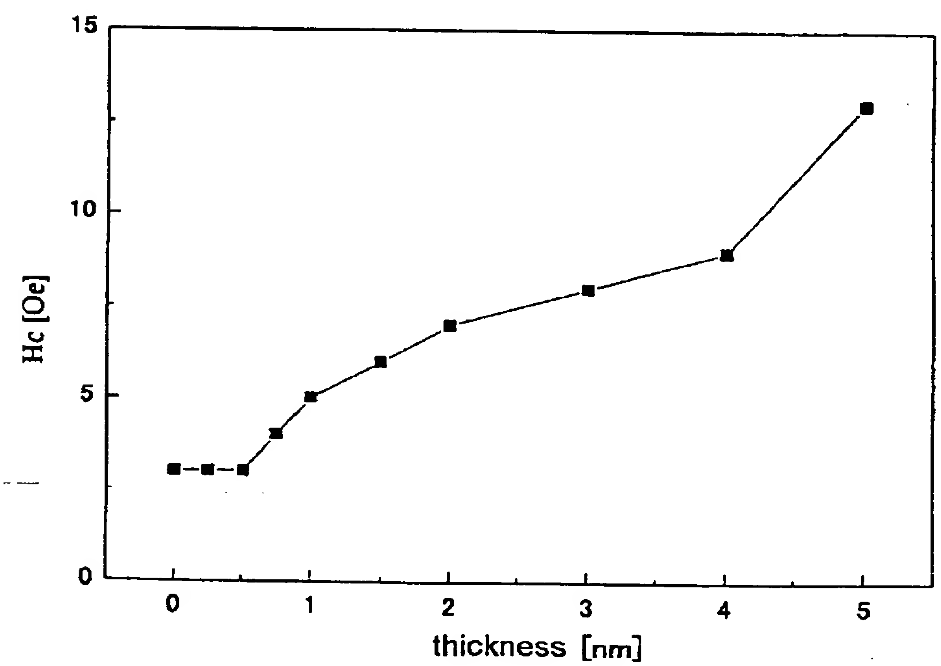
15
10
5
0
Hc [Oe]
0
1
2
3
4
5
thickness [nm]

FIG.11

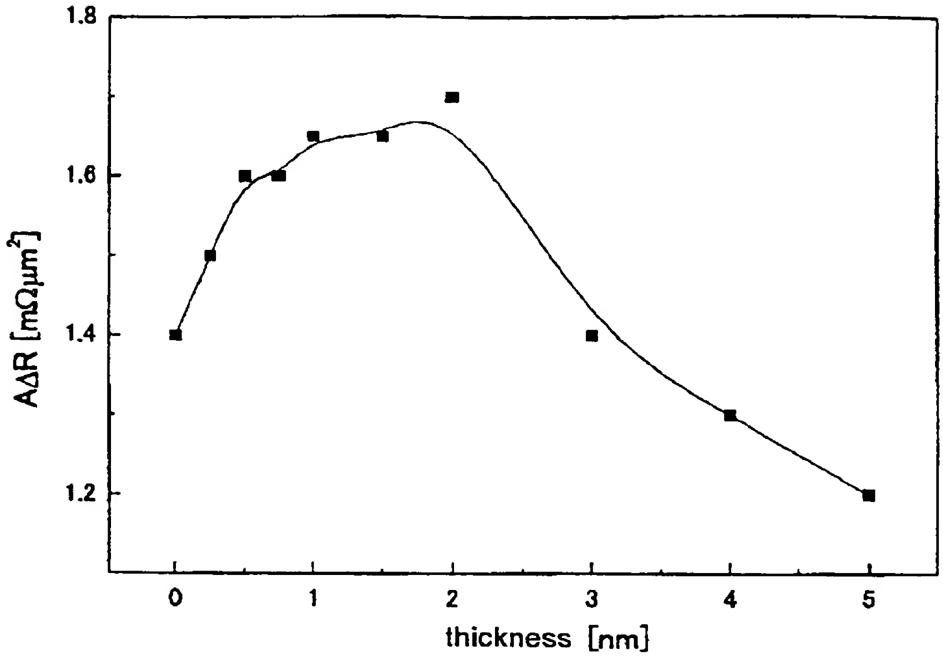
1.8
1.6
1.4
1.2
AΔR [mΩμm²]
0
1
2
3
4
5
thickness [nm]

FIG.12

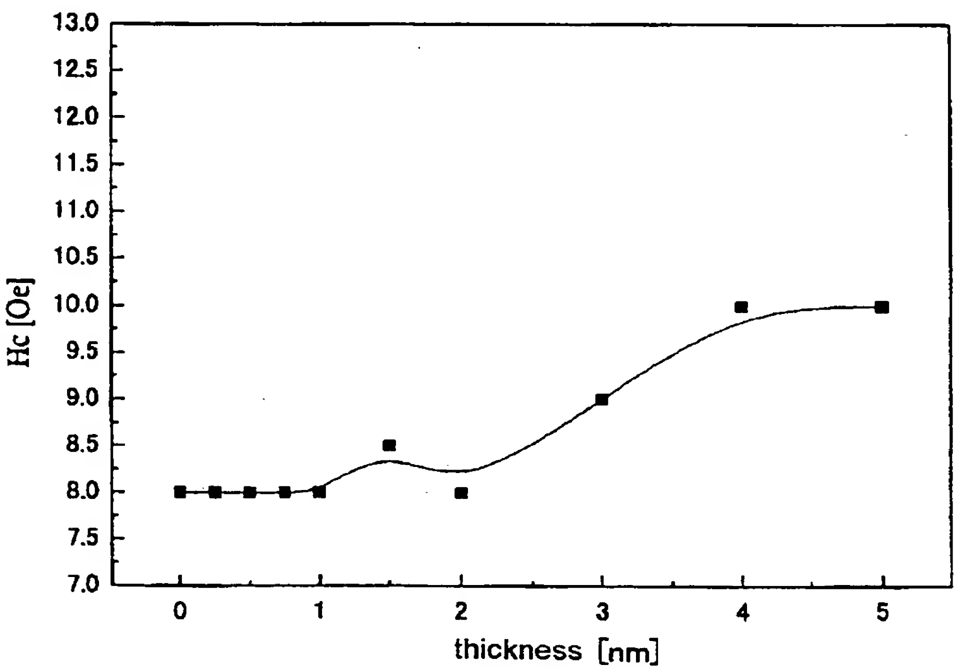
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
Hc [Oe]
0
1
2
3
4
5
thickness [nm]

FIG.13

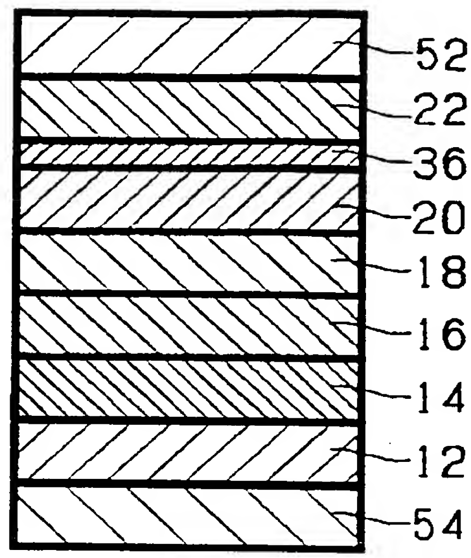

FIG.14

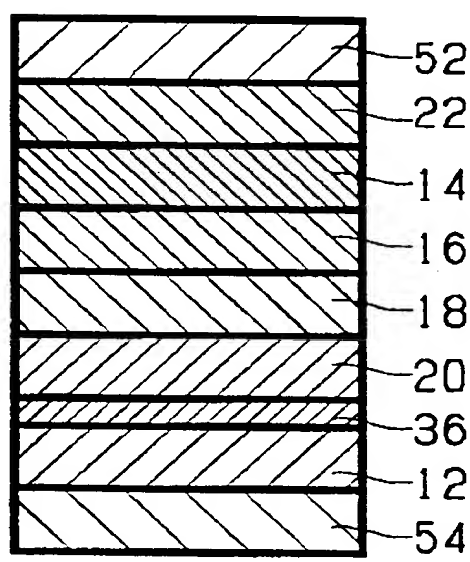

FIG.15

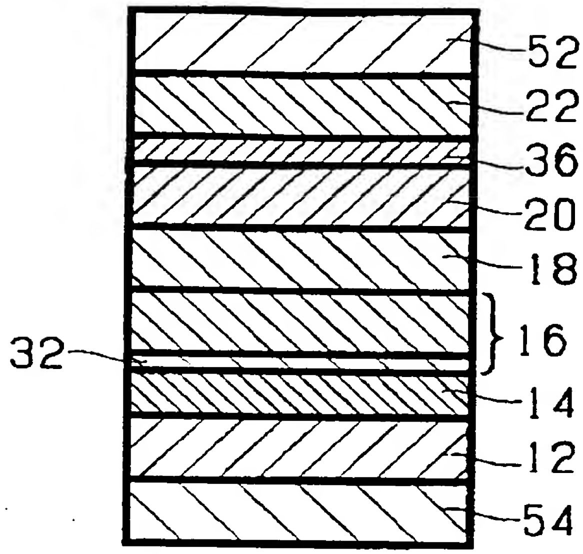

FIG.16

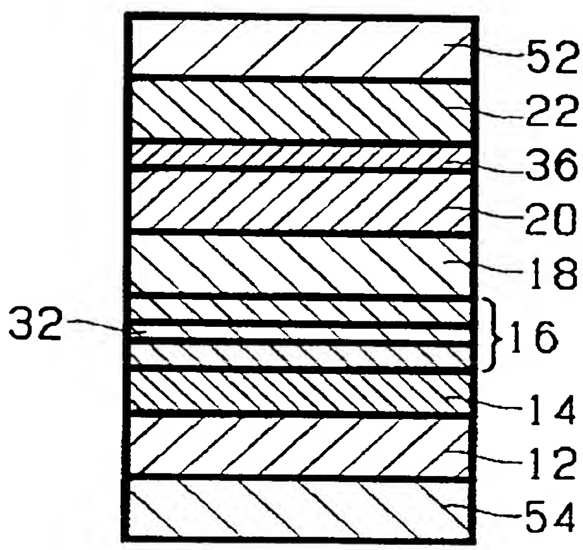

FIG.17

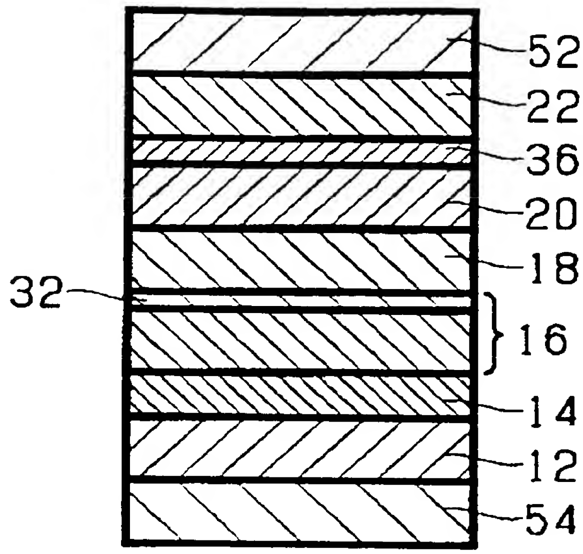

FIG.18

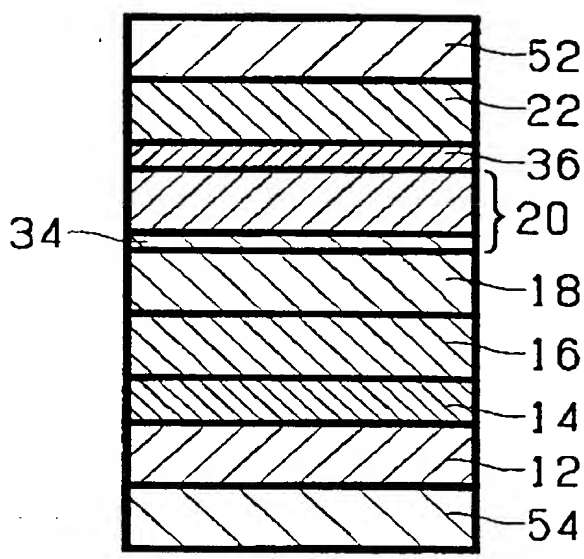

FIG.19

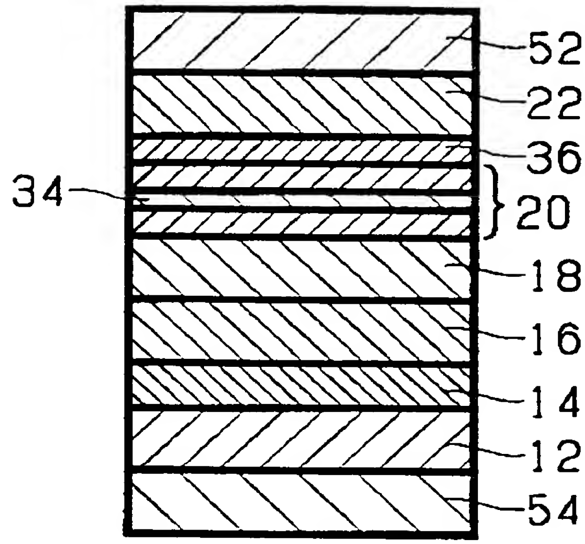

FIG.20

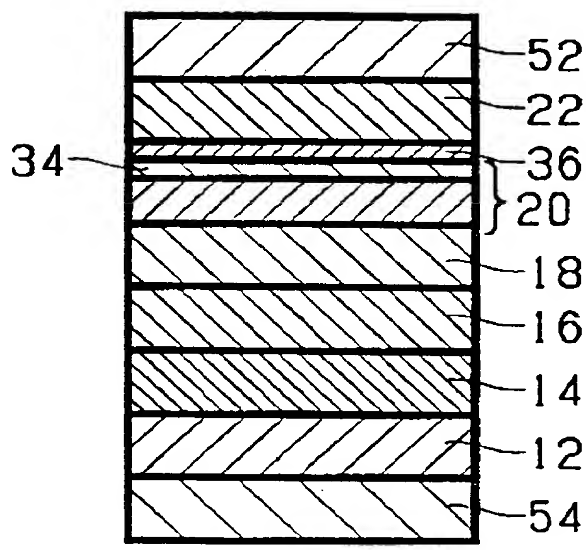

FIG.21

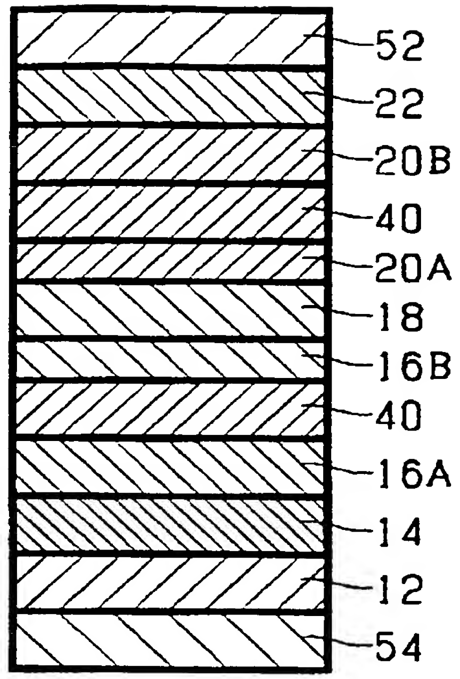
52
22
20B
40
20A
18
16B
40
16A
14
12
54

FIG.22

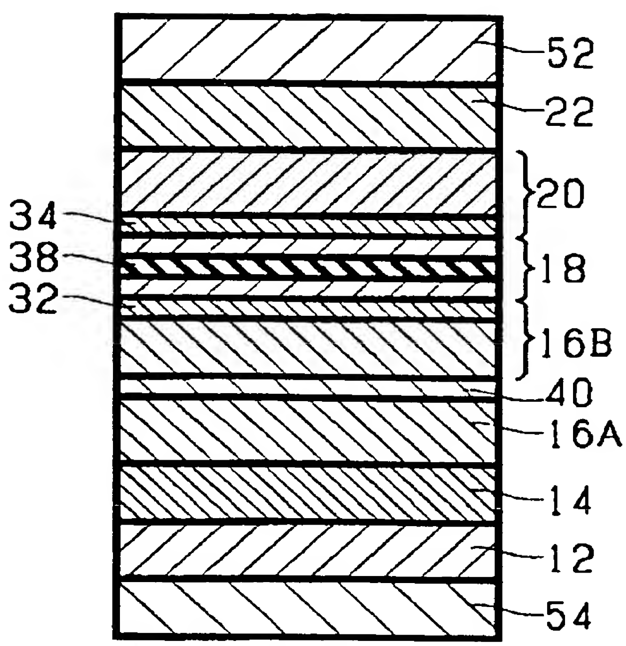
52
22
34
38
32
20
18
16B
40
16A
14
12
54

FIG.23

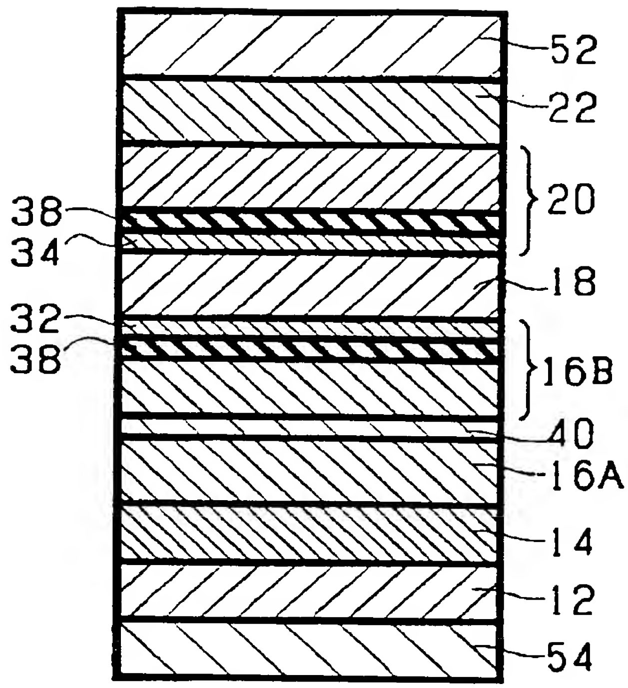
52
22
20
38
34
18
32
38
16B
40
16A
14
12
54

FIG.24

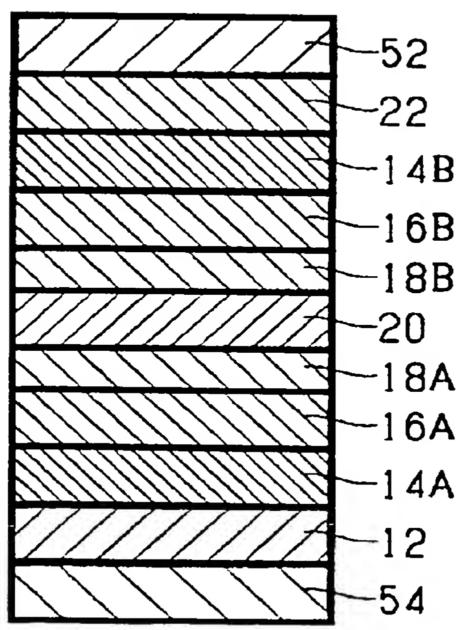
52
22
14B
16B
18B
20
18A
16A
14A
12
54

FIG.25

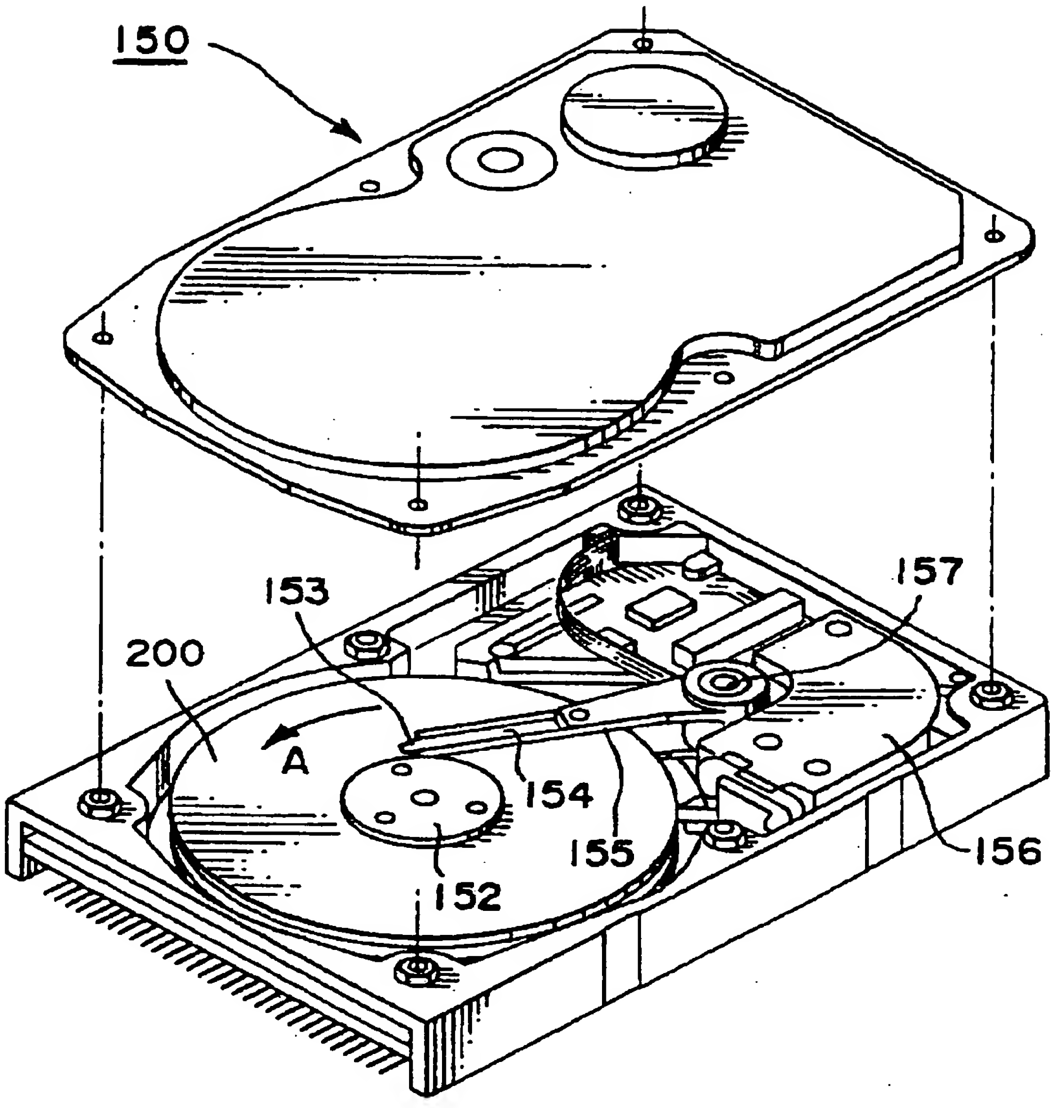

FIG.26

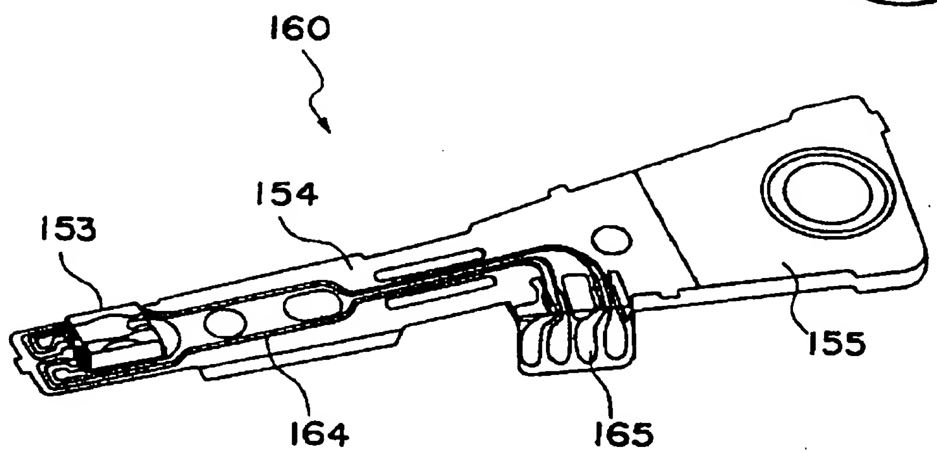

FIG.27

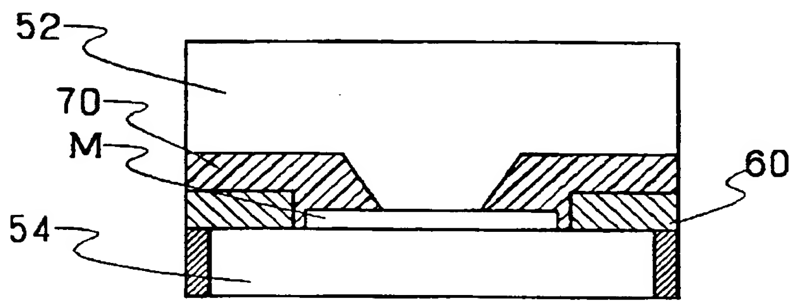

FIG.28

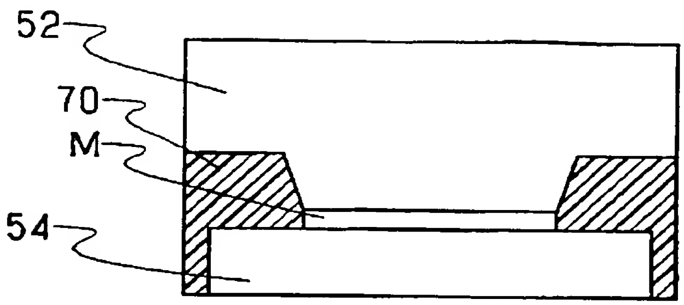

FIG.29

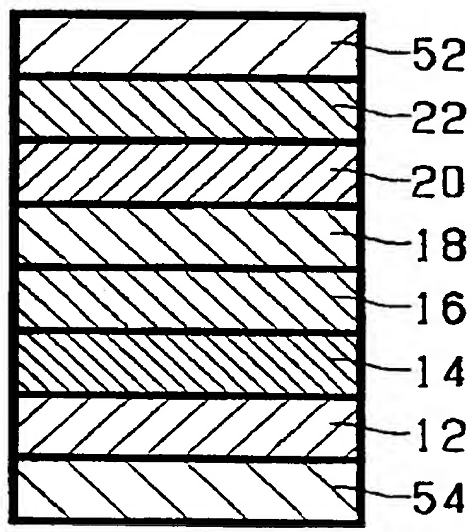

FIG.30